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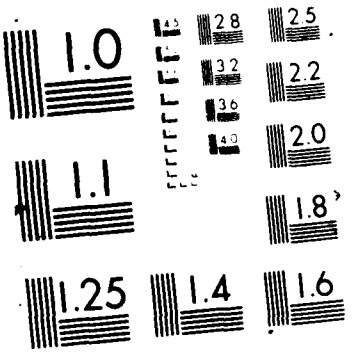
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FOREIGN TECHNOLOGY DIVISION

SELECTION OF POLYMER MATERIALS FOR MANUFACTURING OPTICAL PARTS

by

D. Ye. Kurshinska, G.E. Kudlya

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87

PARTIALLY EDITED MACHINE TRANSLATION

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SELECTION OF POLYMER MATERIALS FOR MANUFACTURING OPTICAL PARTS

By: D. Ye. Kurshinska, G.E. Kudlya

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> In them occurs the state named "night blindness" - hemeralopia, which, according to the current point of view, is a result of damage of the rod-shaped apparatus of the eye.
>
> Page 51.
>
> However, in recent years it has been shown that with the hereditary pigment degenerations in animals the biochemical changes are observed in all celluar elements of the retina.

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Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

Page 51.

SELECTION OF POLYMER MATERIALS FOR MANUFACTURING OPTICAL PARTS.

Engineers D. Ye. Kurshinska, G. E. Kudlya.

Lens in enterprises of Main Administration for the Production of Industrial Engineering Facilities [Glavorgatekhnika] of Minpribor [Ministry of Instrument Making, Automation Devices, and Control Systems of the USSR] are prepared from silica glass. However, for the inaccurate optic/optics lens from polymeric materials [1-5] completely can be used.

In central planning and design office of mechanization and automation [TsPKBMA] (Riga) work on selection of polymeric material for preparing lens [1] was carried out.

FOOTNOTE [1]. Great assistance in this showed/rendered us the consultations of the coworkers of the state optical institute im. S. I. Vavilov - A. M. Nizhin and A. M. Ivanov and Minsk machine shop im. S. I. Vavilov - S. Kh. Gorelik. Experience of the number of Soviet plants and institutes for the preparation/manufacture of lens and the utilization of transparent polymeric materials aided also. ENDFOOTNOTE.

Since from heat-reactive materials lens can be prepared mechanically (prolonged and cumbersome process) or with polymerization

in the form (prolonged process, which is accompanied by large contraction of material), then were selected plastic materials and most productive and cheapest method of treatment/processing thermoplasts - press casting.

For preparing lens by press casting one should use large injection pressure (1500-1800 kg/cm² [1] and even 2500 kg/cm² [2]). Based on this, for the experiments the casting machine (WH-63) with the piston plastification of material and the maximum pressure on the passport 2080 kg/cm² of the Polish firm Zoktod Budow Maszyn Chemicznych (Poznan') was used. TsPKBMA designed experimental mold with refills and internal and external electric heating.

For testing optical and physicomechanical properties of materials samples of following forms were selected: plane-parallel prism and right angled plate, shown in Fig. 1 and 2. For experiments were used the Soviet transparent thermoplasts, whose brands/marks are given in the table.

At preparation/manufacture prototypes technological parameters of founding were varied within following limits: temperature of founding from 170 to 235°C; temperature of casting form - from room to 120°C; time of injection plus aging under pressure - from 5 to 60 s; holding time in casting form - from 50 s to 3 min.

Technological properties of all materials were almost identical

(exception was only test batch of beads casting polymethyl methacrylate of increased yield with poor casting properties).

Most successful samples were selected/taken visually for further investigations on instruments. Coefficients of refraction were measured by goniometric method and corresponded to those given in the literature.

Dispersion of light/world was determined also by goniometric method (see table).

Results of measurements showed that of five investigated materials lowest dispersion have casting polymethyl methacrylate LPT and casting material LSO-M. On the basis of this was made the conclusion that the lens, prepared from these two materials, will possess the lowest chromatic aberration.

This conclusion confirmed observations of lens with diameter of 24 mm, F=60, made from LSO-M and polystyrene in lattice-type polaroids. In polystyrene lens the clearly expressed colored spots were observed, while in lens from the casting material LSO-M - black-grey strips with the smooth transitions.

The same confirmed practical application of lens in diascope. Polystyrene lens gave noticeable chromatic aberration, and lens from LSO-M - entirely insignificant.

Checking plane-parallel plates to resistance to scratching on instrument DS-19 with metallic needle showed that from five materials checked smallest resistance to scratching has polystyrene of brand D. For the remaining materials the resistance to scratching is virtually identical.

Comparison of technological, physicomechanical and optical properties of materials checked made it possible to conclude that casting polymethyl methacrylate of brands LPT and LOS-M is most adequate/approaching material for preparing lens. However, since industrial issue LPT is not yet mastered, then for introducing the polymeric lens in the enterprises. Casting material LSO-M was recommended to Glavorgatekhnika. One of the plants of branch from the end of 1970 completely turned to the preparation/manufacture of lens from the material LSO-M for the review instruments - diascopes and the filmoscopes.

By additional checking of casting material LSO-M by photometric method for light transmission it is established that difference for it in light transmission of yellow, blue, green, white and red light comprises not more than 6%. Hence follows that LSO-M it is possible to use for preparing the optical elements of photo- and movie equipment, intended for photographings to the color films.

Results of measurements of refractive indices and calculation of dispersion and number of Abbe for prism from thermoplasts.

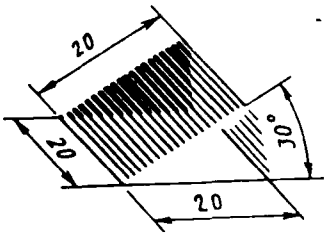
(1) Материал призмы	(2) Преломляющий угол ε в град	(3) Длина волн в ммк	(4) Спектральная линия	(5) Коэффициент преломления n	(6) Относительная дисперсия m*	(7) Число Аббе,**
(8) Полистирол блочный марки Д, ГОСТ 9440—60	29°55′	656	C	1,596	0,0283	35,4
		589	D	1,6015		
		486	F	1,613		
		436		1,6205		
(9) Сополимер МС, СТУ 30-12193—62	29°55′	656	C	1,532	0,0221	41,6
		589	D	1,536		
		486	F	1,544		
		436		1,550		
(10) Литьевой материал ЛСО-М	29°56′	656	C	1,487	0,0204	49,0
		589	D	1,490		
		546	—	1,493		
		486	F	1,497		
		436		1,501		
(11) Полиметилакрилат литьевой ЛПТ, МРТУ 6-05-871-66	29°55′	656	C	1,489	0,0193	51,8
		589	D	1,492		
		516	—	1,4945		
		486	F	1,4985		
		436	—	1,5025		
(12) Полиметилакрилат повышенной текучести	29°54′	656	C	1,487	0,0204	49
		589	D	1,4905		
		546	—	1,493		
		486	F	1,497		
		436	—	1,501		

Key: (1). Material of prism. (2). Refracting angle ε in deg. (3). Wavelength in mμ. (4). Spectral line. (5). Refractive index n. (6). Dispersive power m [1]. (7). Abbe number ν [2]. (8). Polystyrene, block of brand/mark. (9). Copolymer. (10). Casting material. (11). Polymethyl acrylate of casting LPT, MRTU 6-05-871-66. (12). Polymethyl acrylate of increased yield.

FOOTNOTE [1]. Dispersive power was determined from the formula

$$m = \frac{n_F - n_C}{n_D - 1}.$$

[2]. Abbe number was determined from formula $\nu = 1/m$. ENDFOOTNOTE.



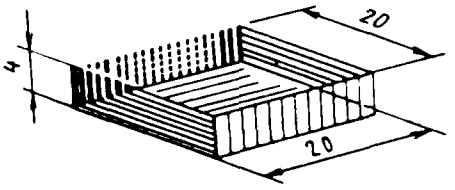


Fig. 1. Fig. 2.

Fig. 1. Plane-parallel prisms.

Fig. 2. Right angled plates.

REFERENCES.

1. S. Kh. Gorelik, A. M. Fareyerov. Preparation/manufacture of optical parts from the polymers by press casting. "Technology and organization of production", 1967, No 1.

2. O. Marek, M. Tomk. Acrylic polymers. M. L., "Chemistry", 1966.

3. G. Shreyer. Casting molding/formation - new method of the manufacture of thick-walled articles made of the polymers. "Chemistry and technology of polymers", 1962, No 12.

4. Greiner H. Erkentnisse über Abwichungen Spritzgegossener optischer Bauteile aus Polymethylmethacrylat. Plast.erarbeiter. Juli. 1968.

5. Cerny M. «Jemna mechanica a ,optika». 1962. № 10, s. 317—322.

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